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RESEARCH ARTICLE

Study of combining ability analysis for seed cotton yield, yield contributing and fibre quality traits in *Desi* cotton (*Gossypium arboreum* L.)

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SUMMARY

The present investigation entitled "Study on heterosis and combining ability for yield, its components and fibre characters in *Desi* cotton (*Gossypium arboreum* L.)" was undertaken to estimate general combining ability effects (GCA) of the parents and specific combining ability effects (SCA) of the crosses. The experimental material comprised of 24 F_1 hybrids obtained by crossing 4 lines with 6 testers in line x tester mating system. Sum total of 36 treatments consisting of 24 crosses, 10 parents and three standard checks were sown in Randomized Complete Block Design. The analysis of variance for combining ability revealed significant general combining ability effects (GCA) and specific combining ability effects (SCA) for all the traits.Among ten parental lines, most of the lines were found to be best general combiner, which had significant general combining ability (GCA)effect for seed cotton yield and its contributing characters includingfibre quality traits.Analysis of variance for means revealed significant differences for all the eighteen characters studied. Among females, PA 741 was found to be the best general combiner for 3 characters *viz.*, days to 50 per cent flowering, days to 50 per cent boll bursting and days to maturity had significant GCA effects. The female PAIG 77 was the best general combiner for three characters *viz*., number of bolls per plant, number of seeds per plant and boll weight. The female PA 809 was the best general combiner for 2.5 per cent span length, fibre fineness/ micronaire, fibre strength, uniformity ratio and short fibre index. Among males, AKA 2004-29 found to be best general combiner for days to 50 per cent flowering, days to 50 per cent boll bursting, days to maturity and ginning outturn. Male parent ARBAS 1301 was also found to be best general combiner for number of sympodia per plant, number of bolls per plant,number of seeds per boll, seed cotton yield per plant, lint index, seed index, plant height, 2.5 per cent span length, fibre fineness, short fibre index and fibre strength. Male parent GAM 162 found to be best genral combiner for ginning outturn, 2.5 per cent span length and short fibre index whereas, CNA 1016 for boll weight. There was close agreement between *per se* performance and GCA as well as SCA effects for most of the characters. Observations on various characters indicated that the crosses showing high heterosis and high SCA effects had high *per se* performance and they involved at least one high combining parent. The combinations PAIG 77 x ARBAS 1301, PA 734 x ARBAS 1301, PA734 x CNA 1016, PA 809 x ARBAS 1301 and PA 741 x JLA 0614 showed significant and desirable SCA effects for most of the yield and fibre quality traits studied, indicating potential for exploiting hybrid vigor in breeding programme.

Key Words : General combining ability (GCA), Specific combining ability, Cotton (SCA), Yield

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Cotton, the king of fibres, occupies a pre-eminent position as a commercial crop in India. Cotton also known as 'white gold' as it is preferred by farmers as cash crop beside other field crops. It is grown commercially in the temperate and tropical regions of more than 70 countries. India is perhaps the first country to make use of cotton. Cotton, the 'white gold' enjoys a pre-eminent status among all cash crops in the country. It is grown commercially in the temperate and tropical regions of more than 70 countries. Specific areas of production include countries such as China, USA, India, Pakistan, Uzbekistan, Turkey, Australia, Greece, Brazil, Egypt etc. Genetic improvement in *Desi* cotton could be gained either through selection or exploitation of specific hybrid. Therefore, more emphasis should be given to increase the seed cotton yield per unit area by developing hybrids with short stature, big boll size, longer staple length with sustained yield in multiple environments. To achieve such desirable characteristics in a new cultivar, proper breeding strategies should be followed. There is an urgent need to promote those cottons that could come closer in quality to the most sought by modern textile mills.

Line x tester analysis provides a systematic approach for selection of appropriate parents on the basis of general combining ability effects (GCA) and superior crosses on the basis of specific combining ability effects (SCA). Combining ability describes the breeding value of parental lines to produce hybrids. Sprague and Tatum (1942) used the terms general combining ability (GCA) to designate the average performance of a line in hybrid combinations and specific combining ability (SCA) as deviation in performance of a cross combination from that predicted on the basis of the general combining abilities of the parents involved in the cross. In order to choose appropriate parents for hybridization as well as specific crosses, it is essential to determine the combining abilitiy of parents and specific combining ability (SCA) of cross combinations by using line x tester analysis. The method has been widely used by plant breeders. This method was applied to improve self and cross-pollinated crop plants.

MATERIAL AND METHODS

The present investigation was undertaken to Study of combining for seed cotton yield, yield contributing and fibre quality traits in *Desi* Cotton (*Gossypium arboreum* L.).Twenty four hybrid combinations derived by crossing 4 *arboreum* lines with 6 testers and their ten parents along with 3 checks were tested at Cotton Research Station, Mahboob Baugh farm, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *Kharif* season of 2015-16. The mean values of all the treatments for the characters under study were worked out. Standard error and critical difference at 1 and 5 per cent level of significance were calculated by using the formula (Panse and Sukhatme, 1967).The general combining ability effects of female lines and testers while the specific combining ability effects of cross combinations were worked out.The test of significance of different genotypes was done according to the procedure given by Kempthorne (1957). The nature of gene action involved in the expression of various quantitative traits is also revealed.

RESULTS AND DISCUSSION

It was observed that the crosses showing high heterosis and high per se performance involved the parents possessing either high x high, high x low and low x low general combining ability effects of parents indicating importance of non-additive genetic variance. The analysis of variance for combining ability is presented in Table 1. The combining ability analysis gives useful information regarding selection of parents based on performance of their hybrids. While specific combing ability helps in selection of specific cross combination. The general combining ability effects of lines are presented in Table 2, while general combining ability effects of testers are presented in Table 3, respectively. The mean squares due to males were significant for days to 50% flowering days to 50% boll bursting, number of

bolls per plant, number of seed per boll, days to maturity, seed cotton yield per plant, seed index, ginning outturn and 2.5 % span length.

The female lines exhibited significant differences for days to 50% flowering, days to 50% boll bursting, number of bolls per plant, number of seed per boll, seed cotton yield per plant, 2.5 % span length, fibre fineness/ micronaire and short fibre index. The mean squares due to crosses exhibited significant differences for all the characters except number of sympodia per plant, number of seed per boll and harvest index whereas male x female interactions was significant for plant height, boll weight,

Table 1 : Analysis of variance for combining ability for different characters

Source	d.f.	Days to 50% flowering	Days to 50% boll bursting	No. of sympodia/ plant	No. of boll/ plant	No. of seed / boll	Boll Weight (g)	Plant height (cm)	Days to maturity	Seed cotton yield/ plant(g)	Lint index	Seed index (g)	Harvest index
Replications	2	1.263	2.888	3.291	0.055	1.430	0.004	21.430	1.847	8.483	0.061	0.401	1.086
Crosses	23	5.294**	6.483**	2.153	8.506**	3.405	0.013**	61.390**	11.173**	53.332**	0.144*	0.792**	2.154
Females	3	7.814*	12.037*	1.421	11.902*	9.125**	0.027	26.125	14.680	56.805*	0.150	0.492	2.094
Males	5	12.822**	15.522**	4.291	21.913**	5.380*	0.008	83.047	27.947**	172.892**	0.277	2.620**	0.717
M x F	15	2.281	2.359	1.587	3.358	1.602	0.012**	61.225**	4.880	12.784	0.099	0.242	2.644
Error	66	1.837	2.168	1.577	2.640	2.112	0.003	25.101	3.486	16.722	0.078	0.174	1.915

Contd… Table 1

Source	d.f.	2.5% Span length (mm)	Fibre fineness/ Micronaire (µg/inch)	Fibre strength (g/tex)	Uniformity ratio (%)	Short fibre index	Ginning outturn (%)
Replications	2	0.131	0.200	0.477	0.666	0.010	0.303
Crosses	23	9.846**	0.487**	4.446**	6.065**	2.582**	3.733**
Females	3	38.754**	1.565*	8.223	7.500	7.269*	2.956
Males	5	12.656*	0.332	3.377	3.000	3.449	12.511**
M x F	15	3.131**	0.324**	4.048**	6.800**	1.355**	0.962
Error	66	0.398	0.022	0.255	1.683	0.181	1.641

*and ** indicate that significance of values at P=0.05 and 0.01, respectively.

Table 2 : Estimates of general combining ability (GCA) for lines

Parents	Days to 50% flowering	Days to 50% boll bursting	No. of sympodia/ plant	No. of bolls/ plant	No. of seeds / boll	Boll weight (g)	Plant height (cm)	Days to maturity	Seed cotton yield/ plant (g)	Lint index	Seed index (g)	Harvest index
PA 741	-0.83*	-1.16**	-0.34	0.06	0.43	-0.03*	-0.70	-1.34**	-0.82	0.11	0.11	0.21
PA 734	-0.22	0.05	0.31	-0.59	-0.45	-0.01	0.84	0.54	1.99*	-0.05	-0.09	0.35
PAIG 77	0.50	0.44	-0.06	1.12**	0.76*	0.05**	-1.31	0.31	0.85	0.02	-0.18	-0.21
PA 809	0.55	0.66*	0.09	-0.59	-0.73*	-0.01	1.18	0.48	-2.02*	-0.09	0.16	-0.35
S.E.(Gi)	0.319	0.347	0.296	0.383	0.342	0.014	1.180	0.440	0.963	0.065	0.098	0.326
S.E.(Gi-Gj)	0.451	0.490	0.418	0.541	0.484	0.020	1.670	0.622	1.363	0.093	0.139	0.461
C.D. (P=0.05)	0.643	0.698	0.595	0.771	0.689	0.029	2.377	0.885	1.940	0.132	0.198	0.656
C.D. (P=0.01)	0.858	0.932	0.795	1.029	0.920	0.039	3.173	1.182	2.589	0.177	0.264	0.876

Contd……Table 2

Parents	2.5% Span length (mm)	Fibre fineness (Micronaire) (µg/inch)	Fibre strength (g/tex)	Uniformity ratio (%)	Short fibre index	Ginning outturn (%)
PA 741	-0.48**	0.02	-0.03	-0.08	-0.01	-0.07
PA 734	-1.10**	0.29**	0.08	-0.25	0.52**	0.43
PAIG 77	-0.57**	0.09*	-0.85**	-0.58	0.37**	-0.52
PA 809	2.16**	-0.40**	0.80**	0.91**	-0.89**	0.16
S.E.(Gi)	0.148	0.035	0.119	0.305	0.100	0.302
S.E.(Gi-Gj)	0.210	0.050	0.168	0.432	0.142	0.427
C.D. (P=0.05)	0.299	0.071	0.239	0.615	0.202	0.607
C.D. (P=0.01)	0.399	0.096	0.320	0.821	0.270	0.811

*and ** indicate that significance of values at P=0.05 and 0.01, respectively

2.5 % span length, fibre strength , uniformity ratio , fibre fineness/micronaire and short fibre index.

Amongst the four female lines, PA 734 (1.99) showed highly significant positive GCA effects and PA 809 (-2.03) exhibited highly negative significant GCA effects for seed cotton yield. The Male parent ARBAS 1301 (5.58) showed positive significant GCA effects where as, GAM 162 (-6.03) exhibited highly negative significant GCA effects. Similar findings were observed Dhamayanthi (2011); Mendez-Natera *et al*. (2012); DaiGang *et al*. (2012) and Kumar *et al*. (2014). For seed cotton yield per plant the cross PA 807 x NDLA 3047 exhibited significant positive specific combining ability (SCA) effect, Similar results were reported by Dhamayanthi (2011); Nidagundi *et al*. (2011) and Kumar *et al*. (2014).

For days to 50 per cent flowering,the female parent PA 741(-1.16) showed significant negative desirable GCA effects. In case of male parents, AKA 2004-29 (-2.05) showed desirable negative significant GCA effects.In case of number of sympodia per plant, male parents ARBAS 1301 (0.87) showed significant positive GCA effect.For number of bolls per plant,Amongst the female parents, PAIG 77 (1.12) showed significant positive GCA effect. In case of male parent, ARBAS 1301 (2.01) showed significant positive GCA effects. Female PAIG 77 (0.76) showed highest positive significant GCA effect where as male parent, ARBAS 1301 (1.09) showed significant positive GCA effects for number of seeds per boll. Jatoi *et al*. (2011); Mendez-Natera *et al*. (2012); DaiGang *et al*. (2012) and Kumar *et al*. (2014) were reported same results.

In case of 2.5 % span length the line PA 809 (2.16) exhibited highly positive significant GCA effect. The lines PA 734 (-1.10), PAIG 77 (-0.57) and PA 741 (-0.48) exhibited highly negative GCA effect. Among the male parent, JLA 0614 (1.06), ARBAS 1301 (0.63) and GAM 162 (0.41) showed positive significant GCA effects, whereas, NDLA 3020 (-1.78) and CNA 1016 (-0.56) showed negative significant GCA effects.

Amongst the male parents, AKA 2004-29 (1.23) and GAM 162 (1.14) showed significant positive GCA effects where as,CNA 1016 (-1.01) and ARBAS 1301 (-0.88) showed negative significant GCA effect for

Table 3 : Estimates of general combining ability (GCA) of testers

Parents	Days to 50% flowering	Days to 50% boll bursting	No. of sympodia/ plant	No. of bolls/ plant	No. of seeds/ boll	Boll weight (g)	Plant height (cm)	Days to maturity	Seed cotton yield/ plant (g)	Lint index	Seed index (g)	Harvest index
JLA 0614	0.38	0.61	0.20	-0.73	-0.56	-0.02	-4.73**	1.26*	-0.54	0.02	0.11	-0.24
AKA 2004-29	-1.69**	-2.05**	-0.20	0.93	-0.56	0.01	-0.31	-2.56**	1.78	0.13	-0.23	0.42
ARBAS 1301	1.13**	0.86*	0.87*	2.01**	1.09*	0.01	3.09*	1.26*	5.58**	0.19*	0.80**	-0.12
NDLA 3020	0.80*	0.86*	-0.04	-0.56	0.34	-0.02	1.51	1.01	-0.98	-0.00	-0.25*	0.08
GAM 162	-0.02	0.27	-0.95*	-1.81**	-0.48	-0.02	0.43	-0.06	-6.03**	-0.17*	-0.54**	-0.18
CNA 1016	-0.61	-0.55	0.12	0.18	0.18	0.03*	0.01	-0.90	0.18	-0.17*	0.11	0.03
S.E.(Gi-)	0.391	0.425	0.362	0.469	0.419	0.017	1.446	0.539	1.180	0.080	0.120	0.399
S.E.(Gi-Gj)	0.553	0.601	0.512	0.663	0.593	0.025	2.045	0.762	1.669	0.114	0.170	0.565
C.D. (P=0.05)	0.787	0.855	0.729	0.944	0.844	0.036	2.911	1.084	2.376	0.162	0.242	0.804
C.D. (P=0.01)	1.051	1.142	0.974	1.260	1.127	0.048	3.886	1.448	3.172	0.217	0.324	1.073

Contd.……Table 3

Parents	2.5% Span lenth (mm)	Fibre fineness (Micronaire) (µg/inch)	Fibre strength (g/tex)	Uniformity ratio (%)	Short fibre index	Ginning outturn (%)
JLA 0614	1.06**	-0.15**	-0.18	0.25	-0.51**	0.22
AKA 2004-29	0.23	0.01	0.21	0.25	-0.90	1.23**
ARBAS 1301	0.63**	-0.23**	0.76**	0.75	-0.26*	-0.88*
NDLA 3020	-1.78**	0.14**	-0.85**	-0.50	1.01**	-0.70
GAM 162	0.41*	0.04	0.01	-0.25	-0.24*	1.14**
CNA 1016	-0.56**	0.19**	0.04	-0.50	0.11	-1.01**
S.E.(Gi)	0.182	0.043	0.145	0.374	0.123	0.369
S.E.(Gi-Gj)	0.257	0.061	0.206	0.529	0.174	0.523
C.D. (P=0.05)	0.366	0.088	0.293	0.754	0.247	0.744
C.D. (P=0.01)	0.489	0.117	0.391	1.006	0.330	0.993

*and ** indicate that significance of values at P=0.05 and 0.01, respectively

Table 4 : Estimates of specific combining ability (SCA) for different characters

Hybrids	Days to 50% flowering	Days to 50% boll bursting	No. of sympodia / plant	No. of bolls/ plant	No. of seeds / boll	Boll weight (g)	Plant height (cm)	Days to maturity	Seed cotton yield/ plant (g)	Lint index	Seed index (g)	Harvest index
PA 741 x JLA 0614	1.33	1.33	0.51	1.68	0.23	0.02	0.62	0.84	-1.32	-0.06	0.23	-0.57
PA 741x AKA 2004-29	0.08	-0.33	-0.73	-1.65	-0.09	0.09**	-5.45	0.01	-2.82	0.06	-0.29	1.16
PA 741x ARBAS 1301	-1.08	-0.91	0.84	0.93	0.56	-0.04	1.45	-1.15	-1.92	-0.02	0.14	-0.57
PA 741x NDLA 3020	-0.08	0.08	0.09	-0.81	-0.34	-0.04	2.04	0.09	1.80	-0.04	-0.37	0.69
PA 741x GAM 162	0.08	0.08	0.01	0.09	-0.84	-0.01	1.45	0.18	1.56	0.12	-0.04	-0.12
PA 741x CNA 1016	-0.33	-0.16	-0.73	-0.23	0.48	-0.02	-0.12	0.01	2.69	-0.05	0.33	-0.58
PA 734 ×JLA 0614	-0.27	0.11	-1.15	0.01	-0.20	-0.08	3.73	1.62	1.86	0.20	-0.05	-0.99
PA 734 x AKA 2004-29	-0.86	-0.88	-0.06	0.68	0.45	0.04	-1.34	-1.87	2.62	-0.14	-0.01	-0.94
PA 734x ARBAS 1301	0.97	0.19	-0.48	-0.73	-1.54	-0.09**	3.56	0.95	1.06	-0.08	0.11	1.64*
PA 734 x NDLA 3020	0.63	0.52	0.76	-0.48	0.20	0.09**	-4.51	0.54	-1.91	0.02	0.01	0.23
PA 734x GAM 162	0.47	0.77	-0.31	-0.23	0.37	-0.02	-3.76	0.29	-2.21	-0.13	-0.17	-0.40
PA 734× CNA 1016	-0.94	-0.72	1.26	0.76	0.70	-0.00	2.31	-1.54	-1.41	0.13	0.12	0.46
PAIG 77× JLA 0614	0.00	0.05	0.23	-0.37	-0.43	-0.02	-2.76	-0.48	-1.94	-0.22	-0.10	1.09
PAIG 77x AKA 2004-29	0.08	0.05	0.31	0.95	-0.09	-0.09**	3.48	0.01	1.52	0.29	-0.03	-0.94
PAIG 77x ARBAS 1301	-0.41	0.13	0.23	0.20	0.90	0.10**	2.40	0.18	1.17	0.23	-0.26	0.15
PAIG 77x NDLA 3020	0.58	0.47	-0.18	0.79	0.65	-0.02	2.31	0.76	-0.56	-0.02	0.02	-0.31
PAIG 77 x GAM 162	-0.58	-0.94	-0.26	0.04	-0.18	0.01	2.40	-0.81	-0.37	-0.01	0.44	-0.12
PAIG 77x CNA 1016	0.33	0.22	-0.34	-1.62	-0.84	0.03	-7.84**	0.34	0.19	-0.26	-0.06	0.13
PA 809x JLA 0614	-1.05	-1.50	0.40	-1.31	0.40	0.01	-1.59	-1.98	1.40	0.08	-0.07	0.46
PA 809 x AKA 2004-29	0.69	1.16	0.48	0.01	-0.26	-0.40	3.31	1.84	-1.31	-0.20	0.34	0.72
PA 809x ARBAS 1301	0.52	0.58	-0.59	-0.40	0.06	0.03	-7.43*	0.01	-0.31	-0.12	0.05	-1.23
PA 809x NDLA 3020	-1.13	-1.08	-0.68	0.51	-0.51	-0.03	0.15	-1.40	0.68	0.04	0.34	-0.60
PA 809 x GAM 162	0.02	0.16	0.56	0.09	0.65	0.02	-0.09	0.34	1.02	0.02	-0.22	0.65
PA 809x CNA 1016	0.94	0.66	-0.18	1.09	-0.34	-0.00	5.65	1.18	-1.47	0.18	-0.39	-0.01
S.E. ±	0.782	0.850	0.725	0.938	0.839	0.035	2.892	1.078	2.361	0.161	0.241	0.799

Contd… Table 4

Hybrids	2.5% Span length (mm)	Fibre fineness (Micronaire) (µg/inch)	Fibre strength (g/tex)	Uniformity ratio (%)	Short fibre index	Ginning outturn (%)
PA 741 x JLA 0614	1.23**	-0.02	0.13	0.58	-1.01**	-0.53
PA 741x AKA 2004-29	0.56	-0.30**	1.53**	0.58	-0.23	0.33
PA 741x ARBAS 1301	-0.73*	0.15	-0.41	-0.91	0.73**	-0.61
PA 741x NDLA 3020	-0.41	0.47**	-0.29	-0.66	0.26	0.74
PA 741x GAM 1	0.38	-0.32**	0.23	1.08	-0.31	0.21
PA 741x CNA 1016	-1.03**	0.02	-1.19**	-0.66	0.56*	-0.15
PA 734 ×JLA 0614	-1.34**	0.40**	-0.78*	-2.25**	0.74**	0.39
PA 734 x AKA 2004-29	-0.12	0.03	-0.58	0.75	-0.17	0.36
PA 734x ARBAS 1301	-0.32	0.08	-0.63*	-0.75	-0.10	0.32
PA 734 x NDLA 3020	0.40	0.00	0.19	-0.50	0.12	-0.88
PA 734x GAM 162	-0.89*	-0.19*	-0.38	0.25	0.78**	-0.04
PA 734× CNA 1016	2.27**	-0.34**	2.19**	2.50**	-1.37**	-0.15
PAIG 77× JLA 0614	0.02	-0.19*	0.85**	1.08	-0.20	0.00
PAIG 77x AKA 2004-29	-0.45	0.23*	-1.55**	-0.91	0.07	0.37
PAIG 77x ARBAS 1301	-0.15	0.18*	-0.20	-0.41	-0.05	0.08
PAIG 77x NDLA 3020	0.37	-0.49**	1.32**	0.83	0.07	0.14
PAIG 77 x GAM 162	0.17	0.30**	0.55	-1.41	-0.06	-0.15
PAIG 77x CNA 1016	0.04	-0.04	-0.97**	0.83	0.17	-0.45
PA 809x JLA 0614	0.08	-0.19*	-0.20	0.58	0.46	0.13
PA 809 x AKA 2004-29	0.01	0.03	0.60*	-0.41	0.34	-1.07
PA 809x ARBAS 1301	1.21**	-0.41**	1.25**	2.08**	-0.58*	0.20
PA 809x NDLA 3020	-0.36	0.00	-1.22**	0.33	-0.46	-0.00
PA 809 x GAM 162	0.33	0.20*	-0.40	0.08	-0.40	-0.01
PA 809x CNA 1016	-1.288**	0.35**	-0.02	-2.66**	0.640*	0.76
S.E. ±	0.364	0.087	0.291	0.749	0.246	0.739

*and ** indicate that significance of values at P=0.05 and 0.01, respectively

ginning out turn.Similar findings were reported by Giri *et al.* (2006), Ashokkumar *et al.* (2010); Saravanan *et al.* (2010); Nidagundi *et al.* (2011); Kumar *et al.* (2013) and Patil *et al.* (2015).

Amongst crosses, the cross PAIG 77 x ARBAS 1301 (0.10), PA 734 × NDLA 3020 (0.09) and PA 741 × AKA 2004-29 (0.09) showed significant positive SCA effects where as, cross PAIG 77 x AKA 2004-29 (-0.09) and PA 734 x ARBAS 1301 (-0.09) showed negative significant SCA effects. For boll weight similar findings were reported by Dhamayanthi (2011); Mendez-Natera *et al.* (2012); Dai Gang *et al.* (2012); Kumar *et al.* (2014); Ambhore *et al.* (2012) and Singh *et al.* (2013).

With regards to seed index Female parents none of the line showed positive or negative significant GCA effects. The Male parent ARBAS 1301 (0.80) showed positive significant GCA effects where as, GAM 162 (-0.54) and NDLA 3020 (-0.25) showed significant negative GCA effects. The results are in agreement with findings of Anandan (2010); Bolek *et al.* (2010); Madhuri *et al.* (2014) and Khan *et al.* (2015)

In case of uniformity ratio the crosses PA 734 x CNA 1016 (2.27), PA 741 × JLA 0614 (1.23) and PA 809 x ARBAS 1301(1.21) showed significant positive SCA effects where as, the cross PA 809 × CNA 1016 (-1.28), PA 741 x CNA 1016 (-1.03), PA 734 × JLA 0614 (-1.34) , PA 734 × GAM 162 (-0.89) and PA 741 × ARBAS 1301(-0.73) showed significant negative SCA effects. Similar results were reported by Preetha and Raveendran (2008); Khan *et al.* (2009); Giri *et al.* (2010); Saravanan *et al.* (2010); Kumar *et al.* (2013); Rangnatha *et al.* (2013) and Kumar *et al.* (2014)

For fibre fineness the line PA 809 (-0.40) exhibited negative significant GCA effect. The lines PA 734 (0.29) and PAIG 77 (0.09) exhibited positive significant GCA effects. Among the testers, CNA 1016 (0.19) and NDLA 3020 (0.14) exhibited significant positive GCA effects, where as, ARBAS 1301 (-0.23) and JLA 0614 (-0.15) showed negative significant GCA effects. Similar results were reported by Khan *et al.* (2009); Giri *et al.* (2010); Saravanan *et al.* (2010); Kumar *et al.* (2013) and Rangnatha *et al.* (2013).

The specific combining ability effects are presented in Table 4. The study of specific combining ability effect (SCA) of fibre quality traits revealed that the cross PA 734 x CNA 1016 , PA 741 × JLA 0614 and PA 809 x ARBAS 1301 exhibited significant positive high sca effect for 2.5 % span length. Whereas the cross PA 734 x CNA 1016 and PA 809 × ARBAS 1301 exhibited positive significant sca effect for uniformity ratio. Crosses PA 734 x CNA 1016, PA 741 x AKA 2004-29 , PAIG 77 x NDLA 3020 and PA 809 × ARBAS 1301 showed desirable positive significant sca effect for fibre strength. Similarly, the cross PAIG 77 x NDLA 3020, PA 809 × ARBAS 1301, PA 734 × CNA 1016, PA 741 × GAM 162 exhibited negative significant sca effect for micronaire value in desirable direction. Similar results were observed by Anandan (2010) and Bolek *et al.* (2010). The cross PAIG 77 × ARBAS 1301 , PA 734 × NDLA 3020 and PA 741 × AKA 2004-29 showed significant positive sca effects for for boll weight.Similar results were reported by Dhamayanthi (2011); Nidagundi *et al.* (2011) and Kumar *et al.* (2014).The cross PA 734 × ARBAS 1301 exhibited significant positive sca effect for harvest index. Similar result were observed by Preetha and Raveendran (2008); Khan *et al.* (2009) and Kumar *et al.* (2014).

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